

# Moderna uses the right dose of data to boost discovery



Cambridge, MA based Moderna believes that messenger RNA, or mRNA, is the “software of life.” Since being founded in 2010, the company has worked to pioneer a new class of medicines based on their extensive research into mRNA.

In a highly regulated industry, Moderna knows the critical importance data plays in key processes for the creation, approval, and distribution of vaccines and therapeutics. When the COVID-19 pandemic started in 2020, the pressure to find a fast, effective, and safe vaccine became a global priority.

As the need for accurate, auditable, and actionable insights has become greater, Moderna has leveraged its modern, multicloud data stack to prioritize the job at hand.

## Finding the Best Solution for the Job

As a research-driven organization, data has been critical to Moderna’s strategy since the beginning. Central to the data-driven strategy is Moderna’s commitment to finding and using the best tools for the job – then integrating those tools to make sure the company is using the best possible solution.

“Moderna’s digital philosophy is around best-of-breed integratable software. If there’s something that solves a problem well, that’s what we will use, if not we will develop it ourselves. We believe in finding the best tool for the job, integrating it, and then making it whole. When we think about infrastructure, if something works, we will integrate and use it,” explains Dave Johnson, VP of Informatics, Data Science, and AI at Moderna.

For years, Moderna has centralized its data in Amazon Redshift and used that to feed data into other tools. While this met their cost and compatibility requirements, teams across Moderna still needed an easier and faster way to access actionable insights. Previously, the majority of employees relied primarily on Excel for data analysis, with some researchers utilizing Spotfire Desktop.

## Key Takeaways

- Leverages a multicloud data strategy to use and integrate the best tools for the job at hand
- Integrates internal and external data sets for a more complete view of clinical trials
- Increases diversity in clinical trials to improve representation
- Reduces the time scientists spend on manual data manipulation to increase research time and collaboration
- Optimizes shipments to reduce costs and meet budget goals

While these tools provided some access to data, they still required significant manual work and set a high barrier to entry. This manual process led to data silos across the organization, limited opportunity to further explore data, and created issues of consistency resulting from various and conflicting versions of the same report.

To help employees access and validate data across the organization, Moderna set out to find the best fit for the job. The top criteria were to improve self-service and exploration, maintain data quality and consistency, and ensure the new tool would be cost-effective and integrate with the tools Moderna already had in place. In 2016, Moderna selected Looker's data application platform to increase organization-wide access to trusted, secure metrics.

With strategic guidance from Looker's Professional Services, Moderna formulated a small team of two people to build a foundation for self-service analytics. Following best practices for scalable and flexible deployments, Moderna was able to access trusted insights from Looker within a few weeks of implementation.

Today, Moderna uses Etleap for real-time ETL into Amazon Redshift. They use Looker for building models, transformation on the fly, data exploration, and self-service. And they use Google sentiment processes to pull insights from their ticketing system, ServiceNow.

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Moderna's modern multicloud data strategy allows the company to centralize, access, and take action on trusted data across the organization.

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## Increasing Diversity in Clinical Trials to Increase Efficacy

When running a clinical trial, there are numerous systems involved to collect data and manage the various clinical processes. There is also additional external information, from epidemiological data that tracks the spread of a pandemic to census and demographic data that provides a view of the populations at risk.

Historically, this information has remained siloed across different sources with clinicians manually attempting to bring the data together in Excel. In addition to being time-consuming and leaving room for human error, this process makes it impossible to create a holistic and up-to-date view of all factors that might impact the operations of the study. As Johnson adds, “It’s nearly impossible to bring everything together and see how factors can relate to or impact one another.”

This limited view into these various factors makes it difficult for those managing the clinical trials to make informed decisions about enrollment and trial execution.

“By pulling all of these disparate data sources into a single place with compelling reports and visualizations in Looker, we’ve enabled our clinical operations team to make real-time decisions about their trials to ensure the highest quality data,” explains Johnson.

Using Looker, Moderna is able to create and take action with a more holistic view of their clinical trials than has previously been possible. Today, the company can analyze within and across internal data sets (such as clinical operations, race, gender, age, risk group) and external data sets (such as epidemiology, census, etc). This visibility provides a more complete view of the study, while making it easier to identify potential trends and outliers. Because of this, Moderna is also able to track and increase the diversity in their clinical trials in a way that hasn’t previously been possible.

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“Our internal data science team developed custom metrics around racial diversity and created performance metrics to understand where we should be relative to each region. We’ve built dashboards to help us look across regions and then filter down to each site and see how they’re performing relative to their peers and where they should be. Now that we can bring in more external data sources alongside our own data, we’re making a very conscious decision to increase diversity in our clinical trials, pursuing more accurate representation. Our teams use the trial enrollment data in Looker many times a day, and they are constantly reviewing the dashboards to see where they are and where they should be. They share them internally, with leadership, and with recruitment to make sure we are producing diversity. This is dramatically changing how we work,” shares Johnson.

Moderna is analyzing population and sample data to inform decision-making across all of its trials, including the search for a COVID-19 vaccine. With Looker, Moderna is able to track, improve, and publicly share the diverse representation within its trial. As Johnson explains, “COVID is disproportionately impacting minorities and our goal is to ensure our trial represents the population.”

## Accessing a Complete View of Research to Increase Exploration & Collaboration

Formulating and testing hypotheses is critical to the scientific process, and for this to work scientists need access to data they can trust. Typically, scientists need to pull data from several sources, interrogate it, identify new questions, collect and add new data, and repeat. It’s a very manual, but important, process.

“Previously, our scientists had to build their own mini data warehouse in Excel and then make graphs. If they had the technical skills, some of them would use Spotfire for additional analysis since it’s a powerful tool for the scientists who know how to use it. Then, they’d have to share it and there would be issues with copy, consistency, and permissioning,” adds Johnson.

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Since implementing Looker, this process has been greatly streamlined to allow scientists to use time they previously spent on manual reporting to focus on research and discovery. This new process helps to eliminate the potential for error from manual reporting and extracts while also increasing the ease with which research data can be shared, tested, and supported.

As Johnson explains, “Now that research data is in the data warehouse, scientists can easily build reports and it’s all safeguarded and integrated. Looker improved collaboration and speed of decision-making because scientists don’t need to fish around. It’s improved quality because we aren’t questioning the source of the data – whether it’s been miscopied or changed, or what version.”

By centralizing research data access with Looker, Moderna has been able to ensure security and accuracy, while improving visibility and exploration.

## Streamlining Shipping & Logistic to Reduce Costs

The research process relies heavily on being able to quickly and securely ship materials across Moderna’s sites and external partners. These requirements keep the Moderna logistics team, which handles all shipping requests, in high demand. Previously, they were greatly exceeding their budgets due to the high volume of requests they were asked to fulfill. They knew they needed to start saving money but they didn’t have the visibility into expenses that they needed in order to identify opportunities to cut costs. While they had built an internal tool to track and manage shipping, it didn’t provide a full picture of the transactions or allow them to compare spend to budgets in real-time.

“In order to identify cost-savings, we first needed to be able to see all shipments and then drill into which departments and types of requests were costing the most,” explains Johnson. “Now, we have all of this in Looker so the team can find opportunities to combine shipments or change the shipment type when appropriate.”

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For a team that manages 60,000+ shipments per year, real-time access to shipping dashboards has allowed the logistics team to greatly improve their processes while also helping them to accurately track and meet their budget targets.

## Harnessing Sentiment Analysis to Improve the User Experience

User feedback can provide invaluable insights. However, it's often unstructured and siloed in different applications, which make it difficult to analyze and develop a comprehensive view.

Previously, Moderna wanted to harness user survey insights from its internal IT support ticketing system, ServiceNow, and other applications used for communication. As Johnson shares, "We wanted to answer basic questions around whether people were happy and to understand sentiment over time so we could identify opportunities, but it just wasn't feasible."

Now, teams use Google's Natural Language Processing (NLP) API to analyze unstructured support ticket data from various sources to analyze sentiment over time. The Moderna team can also do deeper exploration with entity recognition to identify device type, and spot trends that help improve the internal user experience. For example, they can quickly identify and take action if there is an issue impacting certain software applications or hardware.

Today, when a new ticket comes in, the IT support team can search by key components (for example, device types that aren't syncing properly) and then look for correlations across issues over time. This visibility helps the support team more accurately troubleshoot issues and proactively address factors that might impact the user experience. It also allows them to track and make sure they're continually improving the user experience.

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“Now that we can understand sentiment over time, the management team can see if we’re trending in the right direction. This information is relayed back to the help desk team so they can set internal targets regarding the speed and volume of tickets they complete. They can also explore trends by technician and work with them to provide guidance and improve service,” adds Johnson.

## Looking Deeper Into the Data to Discover More

As Moderna continues to drive discovery in medical research, the teams are continually finding new ways to leverage and integrate the best technologies to help meet their primary goal – discovering ways to use mRNA to help people.

“We’ve found that teams become very interested in Looker when their data is added. Then we conduct basic training to help them become data consumers, but from there they start to ask more questions and we train them to explore further and build. Looker has a depth to it – It’s not just a visualization that you look at. People can go deeper as they learn more,” concludes Johnson.